

CLAIMS

What is claimed is:

5 1. An automated method for determining a plurality of characteristics of a breast lesion, the method comprising:

automatically identifying a region of interest in an image, the region of interest comprising the breast lesion;

preprocessing the region of interest to enhance a quality of the image;

10 automatically segmenting the breast lesion in the region of interest;

automatically measuring a plurality of measurements for determining the plurality of characteristics of the breast lesion; and

automatically classifying the breast lesion as benign or malignant based on the plurality of measurements.

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2. The method of claim 1, wherein the automatically measuring step comprises measuring a shape of the breast lesion based on a plurality of shape measurements.

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3. The method of claim 2, wherein the plurality of shape measurements comprises at least one of aspect ratio of the lesion, compactness of the lesion, regularity of a boundary of the lesion, a plurality of margin characteristics, and fuzziness of the boundary of the lesion, wherein each of the plurality of shape measurements indicates the condition of the lesion.

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4. The method of claim 3, wherein the plurality of shape measurements include more than one of aspect ratio of the lesion, compactness of the lesion, regularity of a boundary of the lesion, a plurality of margin characteristics, and fuzziness of the boundary of the lesion, wherein each of the plurality of shape measurements indicates the condition of the lesion.

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5. The method of claim 1, wherein the classification of the lesion comprises a rule based system, the rule based system applying a plurality of pre-determined rules on the plurality of characteristics to indicate the condition of the lesion.

5 6. The method of claim 5, wherein the plurality of pre-determined rules include a tall wide ratio, posterior echo enhancement, posterior shadow, and regularity measure.

10 7. The method of claim 1, wherein the automatically segmenting step comprises generating a three-dimensional plot of the image; wherein the three-dimensional plot comprises a plurality of hills and valleys determined based upon a threshold value.

15 8. The method of claim 7, further comprising slicing a topology of the three-dimensional plot at the threshold value.

9. The method of claim 8, further comprising processing the three-dimensional plot to estimate the region of interest in the image.

20 10. The method of claim 1, wherein the identifying step comprises applying an inverted trough method to identify the region of interest.

11. The method of claim 1, wherein the preprocessing step comprises using an edge preserving smoothing filters.

25 12. The method of claim 1, further comprising applying a fuzzy enhancement technique to distinguish between a brighter region and a darker region.

30 13. The method of claim 1, further comprising applying a multi-scale morphology technique to remove speckles from the region of interest.

14. The method of claim 1, wherein the image is generated by an ultrasound system.

5 15. A system for determining a plurality of characteristics of a breast lesion, the system comprising:

 a memory unit configured for storing an image;

10 a processor configured for automatically identifying a region of interest in the image, the region of interest comprising the breast lesion; the processor further configured for preprocessing the region of interest to enhance a quality of the image; automatically segmenting the breast lesion in the region of interest; automatically measuring a plurality of measurements for determining the plurality of characteristics of the breast lesion; and automatically classifying the breast lesion as benign or malignant based on the plurality of measurements.

15 16. The system of claim 15, wherein processor is further configured for measuring a shape of the breast lesion based on a plurality of shape measurements.

20 17. The system of claim 16, wherein the plurality of shape measurements comprises at least one of aspect ratio of the lesion, compactness of the lesion, regularity of a boundary of the lesion, a plurality of margin characteristics, and fuzziness of the boundary of the lesion, wherein each of the plurality of shape measurements indicates the condition of the lesion.

25 18. The system of claim 17, wherein the plurality of shape measurements include more than one of aspect ratio of the lesion, compactness of the lesion, regularity of a boundary of the lesion, a plurality of margin characteristics, and fuzziness of the boundary of the lesion, wherein each of the plurality of shape measurements indicates the condition of the lesion.

19. The system of claim 15, wherein the processor is further configured for applying a plurality of pre-determined rules on the plurality of characteristics to indicate the condition of the lesion.

5 20. The system of claim 19, wherein the plurality of pre-determined rules include a tall wide ratio, posterior echo enhancement, posterior shadow and regularity measure.

10 21. The system of claim 20, wherein the processor is further configured for generating a three-dimensional plot of the image; wherein the three-dimensional plot comprises a plurality of hills and valleys determined based upon a threshold value.

22. The system of claim 21, wherein the processor is further configured for slicing a topology of the three-dimensional plot at the threshold value.

15 23. The system of claim 22, wherein the processor is further configured for processing the three-dimensional plot to estimate the region of interest in the image.

20 24. The system of claim 15, wherein the processor is further configured for applying a trough system to identify the region of interest.

25 25. The system of claim 15, wherein the image is generated by an ultrasound system.

26. A computer-readable medium storing computer instructions for instructing a computer system to determine a plurality of characteristics of a breast lesion, the computer instructions including:

automatically identifying a region of interest in an image, the region of interest comprising the breast lesion;

30 preprocessing the region of interest to enhance a quality of the image;
automatically segmenting the breast lesion in the region of interest;

automatically measuring a plurality of measurements for determining the plurality of characteristics of the breast lesion; and

automatically classifying the breast lesion as benign or malignant based on the plurality of measurements.

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27. An system for determining a plurality of characteristics of a breast lesion, the system comprising:

means for automatically identifying a region of interest in an image, the region of interest comprising the breast lesion;

10 means for preprocessing the region of interest to enhance a quality of the image;

means for automatically segmenting the breast lesion in the region of interest;

means for automatically measuring a plurality of measurements for determining the plurality of characteristics of the breast lesion; and

15 means for automatically classifying the breast lesion as benign or malignant based on the plurality of measurements.